FINANCIAL ASSISTANCE
FUNDING OPPORTUNITY ANNOUNCEMENT

U.S. Department of Energy
Office of Biomass Program

Demonstration of Integrated Biorefinery Operations for Producing Biofuels and Chemical/Materials Products

Funding Opportunity Number: DE-PS36-07GO97003

Announcement Type: Modification 001

CFDA Number: 81.087 Renewable Energy Research and Development

Issue Date:	**05/01/2007**
Letter of Intent Due Date:	**05/29/2007**
Application Due Date:	**08/14/2007, 11:59 PM Eastern Time**

DATE: May 24, 2007

FROM: James P. Damm, Contracting Officer

TO: All Prospective Applicants

SUBJECT: Amendment No. 001 to Announcement No. DE-PS36-07GO97003, Demonstration of Integrated Biorefinery Operations for Producing Biofuels and Chemical/Materials Products

The Announcement is amended as follows:

1. Under **Part I. Description**, paragraph four, first sentence, "In any case, the minimum scale for the project proposed under this FOA should be designed to produce 1.5 million gallons of biofuel per year or process 70 million dry metric tonnes per day to biofuels and products" is deleted in its entirety and replaced with the sentence, "In any case, the minimum scale for the project proposed under this FOA should be designed to produce 1.5 million gallons of biofuel per year or process 70 dry metric tonnes per day to biofuels and products."

2. Under **Part I. Background**, paragraph two, last sentence, "Its thrust was demonstration and commercialization, rather than research and development, for all products listed in Section 932" is deleted in its entirety and replaced with the sentence, "Its thrust was commercial demonstration, rather than research and development, for all products listed in Section 932."

3. Under **Part III. A. ELIGIBLE APPLICANTS**, the following paragraph is added:

   - Applicants are particularly reminded of the language contained under Part I. Description: "Biorefinery technologies and systems are sought that can proceed rapidly to commercial demonstration following successful completion of the proposed project. Only those applicants or applicant teams who are willing and able to take the integrated technology to a commercial scale in the near-to-mid-term and have a sound business strategy to deploy and/or license and market the technology should apply. To support DOE's goals, it is expected that the biorefinery demonstration projects proposed under this FOA will be operational within three to four years and that, assuming success, subsequent commercial demonstrations would follow shortly thereafter." Therefore, an applicant that is not a commercial entity currently engaged in commercialization and scale-up of process technologies would require a strong commercialization partner to meet this objective.

NOTE: REQUIREMENTS FOR GRANTS.GOV

Where to Submit
Applications must be submitted through Grants.gov to be considered for award. You cannot submit an application through Grants.gov unless you are registered. Please read the registration requirements carefully and start the process immediately. Remember you have to update your CCR registration annually. If you have any questions about your registration, you should contact the Grants.gov Helpdesk at 1-800-518-4726 to verify that you are still registered in Grants.gov.

Registration Requirements
There are several one-time actions you must complete in order to submit an application through Grants.gov (e.g., obtain a Dun and Bradstreet Data Universal Numbering System (DUNS) number, register with the Central Contract Registry (CCR), register with the credential provider, and register with Grants.gov). See http://www.grants.gov/GetStarted. Use the Grants.gov Organization Registration Checklist at http://www.grants.gov/section3/OrganizationRegCheck.pdf to guide you through the process. Designating an E-Business Point of Contact (EBiz POC) and obtaining a special password called an MPIN are important steps in the CCR registration process. Applicants, who are not registered with CCR and Grants.gov, should allow at least 21 days to complete these requirements.

IMPORTANT NOTICE TO POTENTIAL APPLICANTS: When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e. Grants.gov registration).

Questions
Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. Part VII of this announcement explains how to submit other questions to the Department of Energy (DOE).

Application Receipt Notices
After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of five e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to 2 business days from application submission to receipt of email Number 2. You will know that your application has reached DOE when the AOR receives email Number 5. You will need the Submission Receipt Number (email Number 1) to track a submission. The titles of the five e-mails are:

Number 1 – Grants.gov Submission Receipt Number
Number 2 – Grants.gov Submission Validation Receipt for Application Number
Number 3 – Grants.gov Grantor Agency Retrieval Receipt for Application Number
Number 4 – Grants.gov Agency Tracking Number Assignment for Application Number
Number 5 – DOE e-Center Grant Application Received

The last email will contain instructions for the AOR to register with the DOE e-Center. If the AOR is already registered with the DOE e-Center, the title of the last email changes

to: Number 5 – DOE e-Center Grant Application Received and Matched. This email will contain the direct link to the application in IIPS. The AOR will need to enter their DOE e-Center user id and password to access the application.

VERY IMPORTANT – Download PureEdge Viewer
In order to download the application package, you will need to install PureEdge Viewer. This small, free program will allow you to access, complete, and submit applications electronically and securely. For a free version of the software, visit the following web site: http://www.grants.gov/DownloadViewer.

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PART I – FUNDING OPPORTUNITY DESCRIPTION

Legislative Authority

The Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy (EERE) announces a notice of availability of funding for financial assistance from the Office of the Biomass Program. This announcement is being issued under authorization of the Energy Policy Act (EPAct) of 2005, Section 932 (See Appendix C). Amendments to the Internal Revenue Code of 1986 within Title XIII, Energy Policy Tax Incentives cited in EPAct and Sections 1345 and 1346 (renewable fuel and biodiesel credits) of EPAct may provide additional impetus and credit enhancements for potential applicants to respond to this announcement.

Description

This Funding Opportunity Announcement (FOA) requests applicants to design, construct, build and operate/validate an integrated biorefinery demonstration employing terrestrial lignocellulosic feedstocks for the production of some combination of (i) liquid transportation fuel(s) that is a fungible replacement for liquid transportation fuels currently used in the existing infrastructure; (ii) biobased chemicals; and, (iii) substitutes for petroleum-based feedstocks and products. This FOA focuses on potential integrated systems meeting the guidance in EPAct Section 932(c) (1,2 and 4). The proposed biorefinery demonstration scale should be approximately one-tenth of the projected scale of a first-commercial facility. Applicants under this FOA must also provide preliminary design and economic projections for their envisioned first-commercial biorefinery and relate these parameters to the proposed, smaller-scale project.

Per Section 932 (d)1,A, the use of a wide variety of lignocellulosic feedstocks is encouraged, as well as inclusion of technology to collect and treat this wide variety of biomass feedstocks. Section 932 (a)2 further specifies that lignocellulosic feedstocks may not include those biomass components specifically grown for food. Applications proposing the use or conversion to fuel of biomass or biomass components grown for food such as starch, protein or oils, including animal feed, would not be considered compliant.

No plant based oils that are generally intended for use as food can be employed as a feedstock. Hence, soy, canola, sunflower, peanut, etc. oils are excluded. The determining factor is the typical use of the oil in commerce. Use of excess oil production of a food grade oil also does not constitute an eligible feedstock . DDGS intended for animals is also excluded. Municipal Solid Waste (MSW) is not an eligible feedstock. However, biomass as defined in Section 932(a)(1-2) that is segregated from the MSW as a separate stream, could be employed as a feedstock with appropriate considerations for the costs of such segregation, collection, processing, and transportation. Hence, post-sorted MSW, where all recyclables and non-biomass components have been removed, would qualify, but only the remaining dry lignocellulosic stream qualifies as a feedstock for purposes of this FOA.

In any case, the minimum scale for the project proposed under this FOA should be designed to produce 1.5 million gallons of biofuel per year or process 70 million dry

metric tonnes per day to biofuels and products. The objective of this FOA is to support demonstrations that will validate key process metrics and provide the kinds of continuous, operational data at the scale needed to lower the technical risks associated with financing a future commercial plant.

Applicants who propose a scale smaller than 10% of an envisioned commercial plant may be considered if the applicant provides clear and detailed evidence of a successful track record of commercializing similar (e.g., similar amount of new technology, solids processing units and other difficult-to-scale-up unit operations) novel processes based on demonstration facilities operated at a scale smaller than 10% of full commercial.

Biorefinery technologies and systems are sought that can proceed rapidly to commercial demonstration following successful completion of the proposed project. Only those applicants or applicant teams who are willing and able to take the integrated technology to a commercial scale in the near-to-mid-term and have a sound business strategy to deploy and/or license and market the technology should apply.

To support DOE's goals, it is expected that the biorefinery demonstration projects proposed under this FOA will be operational within three to four years and that, assuming success, subsequent commercial demonstrations would follow shortly thereafter. DOE particularly encourages applications that propose to demonstrate novel or breakthrough technologies and those that include appropriate collaboration between and among industrial, academic and national laboratory interests.

The feedstock proposed under this FOA is expected to contribute to the goal of 35 billion gallons of renewable and alternative fuels by 2017 and more beyond this date, thus the applicant must identify a high impact feedstock. A high impact feedstock is defined as one with an ultimate sustainable potential of at least 100 million dry metric tonnes of biomass per year. Alternatively, the proposed technology will be shown to have the ability to convert a variety of biomass feedstocks that together represent a total sustainable potential of at least 100 million dry metric tonnes of biomass per year. This FOA does not address item (e) within Section 932, the University Biodiesel Program.

Applicants should further note that the technology for producing heat and power by conventional means is established technology and this FOA is designed to address the high technical risk associated with converting terrestrial lignocellulosics to biofuels rather than primarily heat and power. Hence for this FOA, applications that propose refineries producing heat and power as the major products would be considered non-responsive. The primary product for these demonstrations should be a fungible replacement for liquid transportation fuels currently used in the existing infrastructure. This could include ethanol, biobutanol, "green" diesel fuels from syngas or pyrolysis oils, etc. but, as noted above, only those that are demonstrated to be fungible replacements for currently used transportation fuels. Evaluation criteria will put heavy weight to demonstrations producing cost-effective biofuels over any other biorefinery configuration.

Background

DOE has funded biorefinery technology development projects since FY 2002 to meet two of the EERE performance goals – dramatically reduce, or even end dependence on imported oil, and spur the creation of the domestic bioindustry.

This FOA is one of two announcements supporting Section 932 of the EPAct 2005. The FOA DE- PS36-06GO96016 "Commercial Demonstration of an Integrated Biorefinery System for Production of Liquid Transportation Biofuels, Biobased Chemicals, Substitutes for Petroleum-based Feedstocks and Products, and Biomass-based Heat/Power" was announced in FY2006 for applications to design, construct, build and operate at the commercial scale, an integrated biorefinery employing lignocellulosic feedstocks. Its thrust was demonstration and commercialization, rather than research and development, for all products listed in Section 932.

In contrast, this FOA DE-PS36-07GO97003 is open to applicants with projects that may include R&D to design, construct, and operate a one-tenth scale biorefinery facility that would be a prototype of a full-scale commercial operation.

An integrated biorefinery is described in the following reference http://www1.eere.energy.gov/biomass/integrated_biorefineries.html, and the components of such integrated systems are the basis for Section 932 (the language of Section 932 is found in Appendix C of this FOA). Applicants selected for an award under FOA DE-PS36-06GO96016 are eligible to apply to this current announcement, but the requirement for diversification of the Program's portfolio may place such applicants at a significant disadvantage.

PART II – AWARD INFORMATION

A. TYPE OF AWARD INSTRUMENT.

DOE anticipates awarding cooperative agreements or technology investment agreements (TIAs) under this program announcement.

TIAs are a new type of assistance instrument for DOE, but they have been used by the Department of Defense for many years to support or stimulate research projects involving for-profit firms, especially commercial firms that do business primarily in the commercial marketplace. TIAs are different from grants and cooperative agreements in that the award terms may vary from the Government-wide standard terms (See DOE TIA regulations at 10 CFR part 603). The primary purposes for including TIAs in the type of available award instruments are to encourage non-traditional Government contractors to participate in this RD&D program and to facilitate new relationships and business practices. A TIA can be particularly useful for awards to consortia (See 10 CFR 603.225(b) and 603.515, Qualification of a consortium).

An applicant may request a TIA if it believes that using a TIA could benefit the RD&D objectives of the program (See section 603.225) and can document these benefits. After an applicant is selected for award, the Contracting Officer will determine if awarding a TIA would benefit the RD&D objectives of the program in ways that likely would not happen if another type of assistance instrument were used (e.g., cooperative agreement subject to all the requirements of 10 CFR part 600). The Contracting Officer will use the criteria in 10 CFR 603, Subpart B to make this determination.

Other Requirements for a TIA. In accordance with 10 CFR 603.215, to the maximum extent practicable, non-Federal parties carrying out a RD&D project under a TIA are to provide at least 50% cost sharing, even though the statutory cost sharing requirement may be less. The Contracting Officer will consider the amount of cost sharing proposed in determining if a TIA is the appropriate instrument for a particular project.

B. ESTIMATED FUNDING.

- Approximately $200,000,000 is expected to be available through FY2011 subject to the availability of appropriated funds in each subsequent year.

C. MAXIMUM AND MINIMUM AWARD SIZE.

- Ceiling (i.e., the maximum amount for an individual award made under this announcement): $ 30,000,000, subject to the availability of appropriated funds for the full project period.
- Floor (i.e., the minimum amount for an individual award made under this announcement): $ 10,000,000, subject to the availability of appropriated funds for the full project period.

D. EXPECTED NUMBER OF AWARDS.

- DOE anticipates making 5-10 awards under this announcement depending on the size of the awards and the availability of appropriated funds.

E. ANTICIPATED AWARD SIZE.

- DOE anticipates that awards will be in the $10,000,000 to $30,000,000 range for the total project period, subject to the availability of appropriated funds.

F. PERIOD OF PERFORMANCE.

- DOE anticipates making awards that will run for up to four (4) years.

G. TYPE OF APPLICATION.

- DOE will only accept new applications under this announcement.
- Applications that employ the findings from previous integrated biorefinery projects funded by DOE and are currently underway, are permitted to apply to this FOA as an extension of their current work. The application should be prepared as if it were a new application as the reviewers will not have access to the information concerning the existing R&D efforts.

PART III - ELIGIBILITY INFORMATION

A. ELIGIBLE APPLICANTS.

- All types of domestic entities are eligible to apply, except other Federal agencies, Federally Funded Research and Development Center (FFRDC) Contractors including DOE National Laboratories, and nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995.

B. COST SHARING .

- The cost share must be at least 50% of the total allowable costs for demonstration and commercial application projects (i.e., the sum of the Government share, including FFRDC contractor costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-Federal sources unless otherwise allowed by law.

C. OTHER ELIGIBILITY REQUIREMENTS.

- **Statutory Requirements and Office of Biomass Program Policy**
  Applicants for this FOA must meet requirements for successful projects given in EPAct 2005, Section 932 with respect to feedstocks, and must be in compliance with Office of Biomass Program Policy. In addition, applications must meet all three of the following requirements to be eligible for consideration:
  - The mass of biomass feedstock throughput is at least 70 dry metric tonnes per

day, or a minimum of 1.5 million gallons per year of biofuel must be produced; **and,**
- Transportation biofuels must be the primary product and are limited to ethanol, biodiesel, biobutanol, or any fungible replacement for gasoline or diesel as a transportation fuel produced from terrestrial lignocellulosics; **and,**
- The proposed feedstock must have an ultimate sustainable potential of at least 100 million dry metric tonnes of biomass per year. Alternatively, the proposed technology must be shown to have the ability to convert a variety of terrestrial lignocellulosic biomass feedstocks that together represent a total sustainable potential of at least 100 million dry metric tonnes of biomass per year.

- **Federally Funded Research and Development Center (FFRDC) Contractors.** FFRDC contractors, including DOE National Laboratories, are not eligible for an award under this announcement, but they may be proposed as a team member on another entity's application subject to the following guidelines:

  Authorization for non-DOE/NNSA FFRDCs. The Federal agency sponsoring the FFRDC contractor must authorize in writing the use of the FFRDC contractor on the proposed project and this authorization must be submitted with the application. The use of a FFRDC contractor must be consistent with the contractor's authority under its award. Save the authorization in a single file named "FFRDC_Auth.pdf," and click on "Add Optional Other Attachment" to attach.

  Authorization for DOE/NNSA FFRDCs. The cognizant contracting officer for the FFRDC must authorize in writing the use of a DOE/NNSA FFRDC contractor on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this authorization.

  > "Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complimentary to the missions of the laboratory, will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory."

  Value/Funding. The value of, and funding for, the FFRDC contractor portion of the work will not normally be included in the award to a successful applicant. Usually, DOE/NNSA will fund a DOE/NNSA FFRDC contractor through the DOE field work proposal system and other FFRDC contractors through an interagency agreement with the sponsoring agency.

  Cost Share. The applicant's cost share requirement will be based on the total cost of the project, including the applicant's and the FFRDC contractor's portions of the effort.

  FFRDC Contractor Effort:

  - The FFRDC contractor effort, in aggregate, shall not exceed **30%** of the total estimated cost of the project, including the applicant's and the FFRDC contractor's portions of the effort.

  Responsibility. The applicant, if successful, will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and the FFRDC contractor.

PART IV – APPLICATION AND SUBMISSION INFORMATION

A. ADDRESS TO REQUEST APPLICATION PACKAGE. Application forms and instructions are available at Grants.gov. To access these materials, go to http://www.grants.gov, select "Apply for Grants," and then select "Download Application Package." Enter the CFDA and/or the funding opportunity number located on the cover of this announcement and then follow the prompts to download the application package. NOTE: You will not be able to download the Application Package unless you have installed PureEdge Viewer (See: http://www.grants.gov/DownloadViewer).

B. LETTER OF INTENT AND PRE-APPLICATION.

1. Letter of Intent.

- Applicants are requested to submit a letter of intent by May 29, 2007. This letter should include the name of the applicant, the title of the project, the name of the Project Director/Principal Investigator(s), a phone number and email address where the Project Director/Principal Investigator(s) may be contacted, the amount of funds requested, and a one-page abstract. Letters of intent and accompanying abstracts will be used by DOE/NNSA to organize and expedite the merit review process. They should not contain any proprietary or sensitive business information. Failure to submit such letters will not negatively affect a responsive application submitted in a timely fashion. The letter of intent should be sent by E-mail to GOBiomass@go.doe.gov.

2. Pre-application.

- Pre-applications are not required.

C. CONTENT AND FORM OF APPLICATION – SF 424 (R&R)

You must complete the mandatory forms and any applicable optional forms (e.g., SF-LLL-Disclosure of Lobbying Activities) in accordance with the instructions on the forms and the additional instructions below**. Files that are attached to the forms must be in Adobe Portable Document Format (PDF) unless otherwise specified in this announcement.**

1. SF 424 (R&R).

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. To activate the instructions, turn on the "Help Mode" (Icon with the pointer and question mark at the top of the form). The list of certifications and assurances referenced in Field 18 can be found on the Applicant and Recipient Page at http://grants.pr.doe.gov, under Certifications and Assurances.

2. RESEARCH AND RELATED Other Project Information.

Complete questions 1 through 5 and attach files. The files must comply with the following instructions:

Project Summary/Abstract (Field 6 on the Form)

The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (i.e., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as the Department may make it available to the public. The project summary must not exceed 1 page when printed using standard 8.5" by 11" paper with 1" margins (top, bottom, left and right) with font not smaller than 11 point. To attach a Project Summary/Abstract, click "Add

Attachment."

Project Narrative (Field 7 on the form)
The project narrative must not exceed 75 pages, including cover page, table of contents, charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right). EVALUATORS WILL ONLY REVIEW THE NUMBER OF PAGES SPECIFIED IN THE PRECEDING SENTENCE. **Appendices required below will NOT count toward the Project Narrative page limit**. Any additional appendices not requested will count toward the Project Narrative page limit. The font must not be smaller than 11 point. Do not include any Internet addresses (URLs) that provide information necessary to review the application, because the information contained in these sites will not be reviewed. See Part VIII.D for instructions on how to mark proprietary application information. To attach a Project Narrative, click "Add Attachment."

The project narrative must include:

- Project Objectives.
  This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.

- Merit Review Criterion Discussion.
  The section should be formatted to address each of the merit review criterion and sub-criterion listed in Section V. A. See Appendix B for specific instructions on what should be addressed in this section. Provide sufficient information so that reviewers will be able to evaluate the application in accordance with these merit review criteria. DOE/NNSA WILL EVALUATE AND CONSIDER ONLY THOSE APPLICATIONS THAT ADDRESS SEPARATELY EACH OF THE MERIT REVIEW CRITERION AND SUB-CRITERION.

- Project Performance Site
  Indicate the primary site where the work will be performed. If a portion of the work will be performed at any other sites, identify those sites, also.

Bibliography & References Cited (Appendix 1 of Project Narrative) Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application**. In order to reduce the number of files attached to your application, please provide the Bibliography and References Cited information as an appendix to your project narrative. This appendix will not count in the project narrative page limitation. Do not attach a file in field 8.**

Facilities & Other Resources (Appendix 2 of Project Narrative) This information is used to assess the capability of the organizational resources, including subawardee resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If

appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. **In order to reduce the number of files attached to your application, please provide the Facilities and Other Resource information as an appendix to your project narrative. This appendix will not count in the project narrative page limitation. Do not attach a file in field 9.**

Equipment (Appendix 3 of Narrative) List major items of equipment already available for this project and, if appropriate identify location and pertinent capabilities**. In order to reduce the number of files attached to your application, please provide the Equipment information as an appendix to your project narrative. This appendix will not count in the project narrative page limitation. Do not attach a file in field 10.**

Other Attachment (Field 11 on the form)
If you need to elaborate on your responses to questions 1-5 on the "Other Project Information" document, provide the information in a single file named "projinfo.pdf". Click on "Add Attachments" in Field 11 to attach file.

Also, attach the following files:

- **Reference Checks on Federal Awards** Provide the information below for at least five, and no more than eight, federal awards that were received by either your organization or principal investigator in the last five years for technologies relevant to this announcement, with award values in excess of $1,000,000. If applicant has fewer than five awards meeting this criteria, first submit those that meet the criteria, and for the remainder, provide information for federal awards over $500,000 received by either the organization or principal investigator for all technologies in the last five years. Save this plan in a single file named "RefChecks.pdf" and click on "Add Attachments" in Field 11 to attach.

  The following information is required for each federal award: 1) AWARD TITLE; 2) INSTRUMENT NUMBER; 3) TOTAL AWARD VALUE ($); 4) PERIOD OF PERFORMANCE (Dates); 5) APPLICANT'S PROJECT DIRECTOR (Name, Address, Telephone Number [including area code]); and 6) FEDERAL AGENCY MAKING AWARD (Agency Name, Federal Program Manager, Federal Program Manager's Address, Federal Program Manager's Telephone Number [including area code]).

- **Budget for DOE/NNSA Federally Funded Research and Development Center (FFRDC) Contractor, if applicable**.
  If a DOE FFRDC contractor is to perform a portion of the work, you must provide a DOE Field Work Proposal in accordance with the requirements in DOE Order 412.1 Work Authorization System. This order and the DOE Field Work Proposal form are available at http://grants.pr.doe.gov. Save this information in a single file. Use up to 10 letters of the FFRDC name (plus .pdf) as the file name (e.g., lanl.pdf or anl.pdf) and click on "Add Attachments" in Field 11 to attach.

- **Environmental Questionnaire**
  Each application must include an environmental checklist, form EF1, which is filled out electronically and submitted via DOE's website. Applicants should go

to: https://www.eere-pmc.energy.gov/NEPA.asp and follow the instructions on the page ("Project Officer" should be listed as "Kevin Craig"). The submission type will be: DOE PMC-EF1 Environmental Checklist. An example of a completed EF1 form can be found at: https://www.eere-pmc.energy.gov/NEPARecipients/EF1DemoSample.pdf.

- **Project Management Plan**
  This plan should identify the activities/tasks to be performed, a time schedule for the accomplishment of the activities/tasks, the spending plan associated with the activities/tasks, and the expected dates for the release of outcomes. Applicants may use their own project management system to provide this information. This plan should identify any decision points and go/no-go decision criteria. If the applicant plans to perform any significant amount of research, the plan must also include a detailed research plan for the research portion of the project. Successful applicants must use this plan to report schedule and budget variances. Save this plan in a single file named "pmp.pdf" and click on "Add Attachments" in Field 11 to attach.

- **SF 424 C Excel, Budget Information – Construction Programs**
  If you plan to have a subawardee provide construction services on your proposed RD&D project, submit a SF 424 C Excel Budget Information – Construction Programs form (available at http://management.energy.gov/business_doe/business_forms.htm) for the subawardee's construction effort, instead of a R&R Subaward Budget Attachment. Complete a SF 424 C budget for each year of support requested and a cumulative budget for the total project period. You must also identify the subawardees construction costs on your RESEARCH AND RELATED BUDGET form on the Subaward/Consortium/Contractual Costs line (Line F.5). Justify the construction costs in your budget justification file and identify who will be performing the work. Save the SF 424 C budgets in a single file named "SF424C.xls," and attach to the RESEARCH AND RELATED Other Project Information form. Click on "Add Attachments" in Field 11 to attach.

- **Pro-forma, as described in Appendix B**
  A pro forma should be included as described in Appendix B under Criterion 1, C. Business Plan, 1. Business and Market Plan, c. "Pro-forma." All requirements in the section must be adhered to. Save the pro-forma in a single file as an Excel Spreadsheet named "Proforma.xls" and click on "Add Attachments" in Field 11 to attach.

3. **RESEARCH AND RELATED Senior/Key Person.**
   Complete this form before the Budget form to populate data on the Budget form. Beginning with the PD/PI, provide a profile for each senior/key person proposed. A senior/key person is any individual who contributes in a substantive, measurable way to the scientific/technical development or execution of the project, whether or not a salary is proposed for this individual. Subawardees and consultants must be included if they meet this definition. For each senior/key person provide:

   Biographical Sketch.
   Complete a biographical sketch for each senior/key person and attach to the "Attach Biographical Sketch" field in each profile. The biographical information for each person must not exceed 2 pages when printed on 8.5" by 11" paper with 1 inch margins (top, bottom, left, and right) with font not smaller than 11 point and must

include:

Education and Training. Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.

Research and Professional Experience: Beginning with the current position list, in chronological order, professional/academic positions with a brief description.

Publications. Provide a list of up to 10 publications most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically.

Patents, copyrights and software systems developed may be provided in addition to or substituted for publications.

Synergistic Activities. List no more than 5 professional and scholarly activities related to the effort proposed.

Related Experience. In addition, submit experience in designing, engineering, constructing and operating facilities of the scale requested in this FOA. Additionally, experience in operating biomass, fuel, or chemical processing of this scale should be provided. An individual may not have experience in all areas but it is the experience with operations of this scale that needs to be included.

Current and Pending Support. Provide a list of all current and pending support (both Federal and non-Federal) for the Project Director/Principal Investigator(s) (PD/PI) and senior/key persons, including subawardees, for ongoing projects and pending applications. For each organization providing support, show the total award amount for the entire award period (including indirect costs) and the number of person-months per year to be devoted to the project by the senior/key person. Concurrent submission of an application to other organizations for simultaneous consideration will not prejudice its review. Save the information in a separate file and attach to the "Attach Current and Pending Support" field in each profile.

4. RESEARCH AND RELATED BUDGET (Total Fed + Non-Fed)

Complete the Research and Related Budget (Total Fed + Non-Fed) form in accordance with the instructions on the form (Activate Help Mode to see instructions) and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this announcement (See PART IV, G).

Budget Justification (Field K on the form)

Provide the required supporting information for the following costs (See R&R Budget instructions): equipment; domestic and foreign travel; participant/trainees; material and supplies; publication; consultant services; ADP/computer services;

subaward/consortium/contractual; equipment or facility rental/user fees; alterations and renovations; and indirect cost type. Provide any other information you wish to submit to justify your budget request. You must have a letter from each third party contributing cost sharing (i.e., a party other than the organization submitting the application) stating that the third party is committed to providing a specific minimum dollar amount of cost sharing. In the budget justification, identify the following information for each third party contributing cost sharing: (1) the name of the organization; (2) the proposed dollar amount to be provided; (3) the amount as a percentage of the total project cost; and (4) the proposed cost sharing – cash, services, or property. By submitting your application, you are providing assurance that you have signed letters of commitment. Successful applicants will be required to submit these signed letters of commitments. Attach a single budget justification file for the entire project period in Field K. The file automatically carries over to each budget year.

5. **R&R SUBAWARD BUDGET (Total Fed + Non-Fed) ATTACHMENT(S) FORM**

   Budgets for Subawardees, other than DOE FFRDC Contractors. You must provide a separate R&R budget for each subawardee that is expected to perform work estimated to be more than $100,000 or 50 percent of the total work effort (whichever is less). Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET (Total Fed + Non-Fed) ATTACHMENT(S) FORM and e-mail it to each subawardee that is required to submit a separate budget. Note: Subwardees must have installed PureEdge Viewer before they can complete the form. After the Subawardee has e-mailed its completed budget back to you, attach it to one of the blocks provided on the form. Use up to 10 letters of the subawardee's name (plus .xfd) as the file name (e.g., ucla.xfd or energyres.xfd).

6. **SF-LLL Disclosure of Lobbying Activities** If applicable, complete SF- LLL. Applicability: If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the cooperative agreement/TIA, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying."

Summary of Required Forms/Files

Your application must include the following documents:

Name of Document	Format	Attach to
SF 424 (R&R)	PureEdge Form	N/A
RESEARCH AND RELATED Other Project Information	PureEdge Form	N/A
Project Summary/Abstract	PDF	Field 6
Project Narrative, including required appendices	PDF	Field 7
Other Attachment	PDF	Field 11

Reference Checks on Federal Awards	PDF	Field 11
Budget for DOE/NNSA FFRDC, if applicable *(Field Work Proposal)*	PDF	Field 11
Environmental Questionnaire	Website Only	Website Only
Project Management Plan	PDF	Field 11
SF-424 C Excel Budget Information – Construction Programs, if applicable	Excel Spreadsheet	Field 11
Pro-forma, as requested in Appendix B	Excel Spreadsheet	Field 11
RESEARCH & RELATED SENIOR/KEY PERSON	PureEdge Form	N/A
Biographical Sketch	PDF	Attach to appropriate block
Current and Pending Support	PDF	Attach to appropriate block
RESEARCH AND RELATED BUDGET (Total Fed + Non-Fed)	PureEdge Form	Attach to appropriate block
Budget Justification	PDf	Field K
R&R SUBAWARD BUDGET (Total Fed + Non-Fed) ATTACHMENT(S) FORM, if applicable	PureEdge Form	N/A
SF-LLL Disclosure of Lobbying Activities, if applicable	PureEdge Form	N/A

D. SUBMISSIONS FROM SUCCESSFUL APPLICANTS.

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment Letter from Third Parties Contributing to Cost Sharing, if applicable

E. SUBMISSION DATES AND TIMES.

1. Pre-application Due Date.

- Pre-applications are not required.

2. Application Due Date.

- Applications must be received by August 14, 2007, 11:59 PM Eastern Time. You are

encouraged to transmit your application well before the deadline. The Grants.gov Helpdesk is not available after 9:00 PM Eastern Time. APPLICATIONS RECEIVED AFTER THE DEADLINE WILL NOT BE REVIEWED OR CONSIDERED FOR AWARD.

F. INTERGOVERNMENTAL REVIEW

- This program is not subject to Executive Order 12372 – Intergovernmental Review of Federal Programs.

G. FUNDING RESTRICTIONS.

Cost Principles**.** Costs must be allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. The cost principles for commercial organization are in FAR Part 31.

Pre-award Costs**.** Recipients may charge to an award resulting from this announcement pre-award costs that were incurred within the ninety (90) calendar day period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 10 CFR part 600. Recipients must obtain the prior approval of the contracting officer for any pre-award costs that are for periods greater than this 90 day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

H. OTHER SUBMISSION AND REGISTRATION REQUIREMENTS

1. **Where to Submit.**
   - **APPLICATIONS MUST BE SUBMITTED THROUGH GRANTS.GOV TO BE CONSIDERED FOR AWARD.** Submit electronic applications through the "Apply for Grants" function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@grants.gov.

2. **Registration Process.**
   You must COMPLETE the one-time registration process (all steps) before you can submit your first application through Grants.gov (See www.grants.gov/GetStarted). **We recommend that you start this process at least three weeks before the application due date**. It may take 21 days or more to complete the entire process. Use the Grants.gov Organizational Registration Checklists at http://www.grants.gov/assets/OrganizationRegCheck.pdf to guide you through the process. IMPORTANT: During the CCR registration process, you will be asked to designate an E-Business Point of Contact (EBIZ POC). The EBIZ POC must obtain a special password called "Marketing Partner identification Number" (MPIN).

- When you have completed the process, you should call the Grants.gov Helpdesk at 1-800-518-4726 to verify that you have completed the final step (i.e. Grants.gov registration).

3. Application Receipt Notices

After an application is submitted, the Authorized Organization Representative (AOR) will receive a series of five e-mails. It is extremely important that the AOR watch for and save each of the emails. It may take up to 2 business days from application submission to receipt of email Number 2. You will know that your application has reached DOE when the AOR receives email Number 5. You will need the Submission Receipt Number (email Number 1) to track a submission. The titles of the five e-mails are:

Number 1 - Grants.gov Submission Receipt Number
Number 2 - Grants.gov Submission Validation Receipt for Application Number
Number 3 - Grants.gov Grantor Agency Retrieval Receipt for Application Number
Number 4 - Grants.gov Agency Tracking Number Assignment for Application Number
Number 5 - DOE e-Center Grant Application Received

The last email will contain instructions for the AOR to register with the DOE e-Center. If the AOR is already registered with the DOE e-Center, the title of the last email changes to:
Number 5 – DOE e-Center Grant Application Received and Matched

This email will contain the direct link to the application in IIPS. The AOR will need to enter their DOE e-Center user id and password to access the application.

Part V - APPLICATION REVIEW INFORMATION

A. CRITERIA

1. Initial Review Criteria.

Prior to a comprehensive merit evaluation, DOE will perform an initial review to determine that (1) the applicant is eligible for an award; (2) the information required by the FOA has been submitted; (3) the minimum cost share has been met; and (4) the proposed project is responsive to the objectives of the FOA including all of the following requirements:

- The mass of biomass feedstock throughput is at least 70 dry metric tonnes per day, or alternatively, a minimum of 1.5 million gallons per year of biofuel must be produced; **and**,
- Transportation biofuels are the primary product. These fuels are limited to ethanol, biodiesel, biobutanol, or any fungible replacement for gasoline or diesel as a transportation fuel produced from terrestrial lignocellulosics; **and,**
- The proposed feedstock has an ultimate, sustainable potential of at least 100 million dry metric tonnes of terrestrial lignocellulosic biomass per year. Alternatively, the proposed technology has the ability to convert a variety of biomass feedstocks that together represent a total sustainable potential of at least 100 million dry metric tonnes of terrestrial lignocellulosic biomass per year.

Requirement on feedstocks.

The definitions found in Section 932(a) of EPAct 2005 provide specific guidance on suitable feedstocks. In addition, DOE has determined that the following is consistent with the guidance in Section 932:

a. No plant based oils that are generally intended for use as food can be employed as a feedstock. Hence, soy, canola, sunflower, peanut, etc. oils are excluded. The determining factor is the typical use of the oil in commerce. Use of excess oil production of a food grade oil does not constitute an eligible feedstock either.
b. No food, including DDGS intended for animals, qualifies for a feedstock; only waste materials as defined in Section 932(a)(1-2).

c. Municipal Solid Waste (MSW) is also not an eligible feedstock. However, biomass as defined in Section 932(a)(1-2) that is segregated from the MSW as a separate stream, could be employed as a feedstock with appropriate considerations for the costs of such segregation, collection, processing, and transportation. Hence, post-sorted MSW, where all recyclables and non-biomass components have been removed, would qualify, but only the remaining dry lignocellulosic stream qualifies as a feedstock for purposes of this FOA. Assuming such feedstocks are obtained at no cost is not a realistic scenario.

Non-compliant applications will not be eligible for further consideration.

2. **Merit Review Criteria.** Applications will be reviewed in accordance with the following guidelines:

All compliant applications will undergo a comprehensive technical evaluation by a Merit Review Committee. This evaluation will consist of a merit review of the submitted written application (a written application evaluation). In addition, this review may be followed by a request for an oral presentation (an oral presentation evaluation) for the highest ranked applications. Finally, in addition to or in place of the oral presentations, written clarifications or additional detail related to criteria responses may be requested.

The written application evaluation will consist of an examination of each application to ensure that all requirements listed in the document cited in Appendix B, Format and Instructions for the Project Narrative, are addressed. The written application evaluation will consist of a critical examination of the quality of the responses to Appendix B instructions with respect to each of the evaluation criteria. If an application does not address a requirement of Appendix B, the application's score will reflect the omission.

The oral presentation, if determined necessary, will consist of two parts – the oral presentation (up to one hour) by the highest ranked applicants followed by a question and answer session (up to one hour) conducted by the Merit Review Committee. The purpose of the oral presentation is to ensure that the Merit Review Committee fully understands the details of the proposed project and has an opportunity to ask clarifying questions of the applicants. The oral presentation evaluation will consist of a critical examination of the quality of the responses to Appendix B instructions with respect to each of the evaluation criteria.

A written request of clarification or additional detail may be employed in addition to, or in lieu of, the oral presentation. If deemed necessary, the applicant will be contacted with specific items to address. This information, if requested, may supplement or replace the oral presentation. The written clarification request, if employed, will support the purposes and evaluation outlined above related to, or in place of, the oral presentation.

It is DOE's intent to schedule oral presentations, if determined necessary, in early December 2007. The presentation slides (only electronic slides, not viewgraphs), including hard paper copies, must be provided to DOE within five working days of the actual scheduled oral presentation meeting. Proprietary information must be marked on the slides.

A final ranking of these applications will be made by the Merit Review Committee following the oral presentations and/or written clarifications.

The use of independent engineering consultant(s) will be employed in all aspects of the

merit review process. A program policy factor review will be conducted by DOE personnel within the Biomass Program following the merit review process.

The objective merit review criteria applied to the information provided under the project narrative establishes what DOE considers to be the determining factors for award. Cost will not be point scored, but cost will be evaluated relative to the proposed plans. The objective merit review criteria listed below will be used by evaluators to determine the value of the application in meeting the objective outcomes of the FOA. The evaluation weights for the objective merit review criteria are shown as percentages for each criterion. Criterion 1 has three major categories: 1) Feedstock and feed supply system, 2) Economics, emissions and energy, competitive advantage, success factors, and 3) Business plan, with accompanying sub-criteria. Criterion 2 is comprised of two categories: 1) Approach and 2) Feasibility, and its accompanying sub-criteria. The specific review criteria are as follows:

Criterion 1. Commercialization Plan. The likelihood that the proposed technology will be successfully commercialized in the near- to-mid-term, assuming successful completion of this demonstration project (50%)

A. **Feedstock and feed supply system**: The extent to which the proposed feedstock(s) has the potential to contribute meaningfully, from a cost and volume perspective, to reduction of oil imports and achieving the President's 2017 goal for renewable and alternative fuel production. **(12.5%)**
B. **Economics, emissions and energy, competitive advantage, success factors:** The extent to which the proposed process demonstrates compelling economics and competitive advantages that justify the demonstration of the proposed integrated system and the extent to which the applicant has defined the critical factors that will measure success. **(25%)**
C. **Business Plan:** Provide information to assess the likelihood that the proposed business plan will lead to the successful near- to mid-term commercialization and deployment of the integrated biorefinery technology. **(12.5%)**

Criterion 2. Demonstration Plan. The likelihood that the proposed project is able to demonstrate the integration of multiple unit operations in producing at least one fungible biofuel or multiple products (including a fungible biofuel as the primary product), and the extent to which the proposed project supports the Commercialization Plan presented in Criterion 1 (50%)

A. **Approach**: The extent to which the proposed feedstock, process engineering evaluations of the proposed technology or system, biorefinery siting, energy, emissions, and economic analyses are properly developed, and the extent to which the project demonstrates that the proposed biorefinery technology can potentially operate as an integrated system to economically produce any one or more of the products listed in Section 932(d)(1)(B)(i-iii).

   Preference will be given to projects that demonstrate novel or breakthrough technologies, that include appropriate collaboration between and among industrial, academic and national laboratory interests, and that produce, as the primary product, bio-based fuels that are fungible replacements for liquid transportation fuels currently used in the existing infrastructure. Biorefinery technologies and systems are sought that can proceed rapidly to commercial demonstration following successful completion of the proposed project. **(25%)**

B. Feasibility: The likelihood that the proposed demonstration can be accomplished within the proposed budget and schedule by the team given their experience, past performance, past progress on the proposed technology, available financial and material resources, project plan, proposed budget, and operational management. **(25%)**

3. Other Selection Factors

The selection official may consider the following program policy factors in the selection process:

- Geographic diversity per Section 932 of EPAct 2005
- Cost share in excess of the minimum required 50%
- Technological diversity, e.g., choice of feedstocks and outputs per Section 932 of EPAct 2005
- Congruity to current DOE Portfolio: Project provides needed portfolio diversity, contributes to portfolio balance across priority technical areas, and /or provides needed adjustment in portfolio risk profile to achieve desired balance with respect to technical approaches, stages of development, and technical and commercialization risks

B. REVIEW AND SELECTION PROCESS.

1. Merit Review.

- Applications that pass the initial review will be subjected to a merit review in accordance with the guidance provided in the "Department of Energy Merit Review Guide for Financial Assistance and Unsolicited Proposals." This guide is available under Financial Assistance, Regulations and Guidance at http://professionals.pr.doe.gov/ma5/ma-5web.nsf/?Open.
- DOE will conduct an independent third party review of financial capability of applicants (including personal credit information of the principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

2. Selection.

- The Selection Official will consider the merit review recommendation, program policy factors, and the amount of funds available.

3. Discussions and Award.

- The Government may enter into discussions with a selected applicant for any reason deemed necessary, including, but not limited to: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 10 CFR part 600; and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES.

DOE anticipates notifying applicants selected for award by February 6, 2008 and making awards by May 9, 2008 .

Part VI - AWARD ADMINISTRATION INFORMATION

A. AWARD NOTICES.

1. Notice of Selection.

- DOE will notify applicants selected for award. This notice of selection is not an authorization to begin performance. (See Part IV.G with respect to the allowability of pre-award costs.)

  Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award.

A Notice of Financial Assistance Award issued by the contracting officer is the authorizing award document. It normally includes, either as an attachment or by reference: 1. Special Terms and Conditions; 2. Applicable program regulations, if any; 3. Application as approved by DOE/NNSA.; 4. DOE assistance regulations at 10 CFR part 600, or, for Federal Demonstration Partnership (FDP) institutions, the FDP terms and conditions; 5. National Policy Assurances To Be Incorporated As Award Terms; 6. Budget Summary; and 7. Federal Assistance Reporting Checklist, which identifies the reporting requirements.

B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS.

1. Administrative Requirements.

The administrative requirements for DOE grants and cooperative agreements are contained in 10 CFR part 600 (See: http://ecfr.gpoaccess.gov), except for grants made to Federal Demonstration Partnership (FDP) institutions. The FDP terms and conditions and DOE FDP agency specific terms and conditions are located on the National Science Foundation web site at http://www.nsf.gov/awards/managing/fed_dem_part.jsp.

2. Special Terms and Conditions and National Policy Requirements.

The DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at http://grants.pr.doe.gov. The National Policy Assurances To Be Incorporated As Award Terms are located at http://grants.pr.doe.gov.

3. Intellectual Property Provisions.

The Government's rights to Intellectual Property will be subject to negotiation prior to award. However, the standard DOE financial assistance intellectual property provisions applicable to the various types of recipients are located at http://www.gc.doe.gov/techtrans/sipp_matrix.html.

Statement of Substantial Involvement. Substantial involvement is based on the following justifications. The complexity of these projects, the need for DOE involvement in each go no/go decision point, the high visibility within the bioindustry for these demonstrations, and the significant investment by the federal government in cost sharing the efforts. In addition, if an effort involves a DOE FFRDC, DOE would want to insure the efficient and facile interaction between the successful applicant and the FFRDC laboratory.

C. REPORTING.

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The proposed Checklist for this program is https://www.eere-pmc.energy.gov/procurenet/FinancialAssistance/Forms/DOE_Forms/DOEF4600_2.doc

PART VII - QUESTIONS/AGENCY CONTACTS

A. QUESTIONS

Questions regarding the content of the announcement must be submitted through the "Submit Question" feature of the DOE Industry Interactive Procurement System (IIPS) at http://e-center.doe.gov. Locate the program announcement on IIPS and then click on the "Submit Question" button. Enter required information. You will receive an electronic notification that your question has been answered. DOE/NNSA will try to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website.

Questions relating to the registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@grants.gov. DOE cannot answer these questions.

B. Agency Contact

Name: Melissa Wise
E-mail: Melissa.Wise@go.doe.gov
Fax: 303 275-4754
All questions should be submitted through the "Submit Question" feature of IIPS (See Section A in this Part)

PART VIII - OTHER INFORMATION

A. MODIFICATIONS.

Notices of any modifications to this announcement will be posted on Grants.gov and the DOE Industry Interactive Procurement System (IIPS). You can receive an email when a modification or an announcement message is posted by joining the mailing list for this announcement through the link in IIPS. When you download the application at Grants.gov, you can also register to receive notifications of changes through Grants.gov.

B. GOVERNMENT RIGHT TO REJECT OR NEGOTIATE.

DOE reserves the right, without qualification, to reject any or all applications received in response to this announcement and to select any application, in whole or in part, as a basis for negotiation and/or award.

C. COMMITMENT OF PUBLIC FUNDS.

The Contracting Officer is the only individual who can make awards or commit the Government to the expenditure of public funds. A commitment by other than the Contracting Officer, either explicit or implied, is invalid.

D. PROPRIETARY APPLICATION INFORMATION.

Patentable ideas, trade secrets, proprietary or confidential commercial or financial information, disclosure of which may harm the applicant, should be included in an application only when such information is necessary to convey an understanding of the proposed project. The use and disclosure of such data may be restricted, provided the applicant includes the following legend on the first page of the Project Narrative and specifies the pages of the application which are to be restricted:

"The data contained in pages _____ of this application have been submitted in confidence and contain trade secrets or proprietary information, and such data shall be used or disclosed only for evaluation purposes, provided that if this applicant receives an award as a result of or in connection with the submission of this application, DOE shall have the right to use or disclose the data herein to the extent provided in the award. This restriction does not limit the government's right to use or disclose data obtained without restriction from any source, including the applicant."

To protect such data, each line or paragraph on the pages containing such data must be specifically identified and marked with a legend similar to the following:

"The following contains proprietary information that (name of applicant) requests not be released to persons outside the Government, except for purposes of review and evaluation." However, the Project Summary/Abstract should not contain any proprietary or protected information.

E. EVALUATION AND ADMINISTRATION BY NON-FEDERAL PERSONNEL.

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign conflict of interest and non-disclosure agreements prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

F. INTELLECTUAL PROPERTY DEVELOPED UNDER THIS PROGRAM.

Patent Rights. The government will have certain statutory rights in an invention that is conceived or first actually reduced to practice under a DOE award. 42 U.S.C. 5908 provides that title to such inventions vests in the United States, except where 35 U.S.C. 202 provides otherwise for nonprofit organizations or small business firms. However, the Secretary of Energy may waive all or any part of the rights of the United States subject to certain conditions. (See "Notice of Right to Request Patent Waiver" in paragraph G below.)

Rights in Technical Data. Normally, the government has unlimited rights in technical data created under a DOE agreement. Delivery or third party licensing of proprietary software or data developed solely at private expense will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE's own needs or to insure the commercialization of technology developed under a DOE agreement.

G. NOTICE OF RIGHT TO REQUEST PATENT WAIVER.

Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this announcement, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.

Domestic small businesses and domestic nonprofit organizations will receive the patent rights clause at 37 CFR 401.14, i.e., the implementation of the Bayh-Dole Act. This clause permits domestic small business and domestic nonprofit organizations to retain title to subject inventions. Therefore, small businesses and nonprofit organizations do not need to request a waiver.

H. NOTICE REGARDING ELIGIBLE/INELIGIBLE ACTIVITIES.

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

I. NOTICE OF RIGHT TO CONDUCT A REVIEW OF FINANCIAL CAPABILITY.

DOE reserves the right to conduct an independent third party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

J. REAL PROPERTY AND EQUIPMENT.

It is the intent of the Department not to assert disposition rights or interests to property and equipment acquired by applicants in the prosecution of projects awarded under this Funding Opportunity Announcement. The Department intends to waive its rights under 10 C.F.R. § 600.321 for such projects in order to facilitate third party debt and equity participation in the projects.

REFERENCE MATERIAL

Appendix A – Definitions

"Amendment" means a revision to a solicitation.

"**Applicant**" means the legal entity or individual signing the Application. This entity or individual may be one organization or a single entity representing a group of organizations (such as a Consortium) that has chosen to submit a single Application in response to a solicitation.

"**Application**" means the documentation submitted in response to a solicitation. NOTE: Application is referred to as Proposal in IIPS.

"Authorized Organization Representative (AOR)" is the person with assigned privileges who is authorized to submit grant applications through Grants.gov on behalf of an organization. The privileges are assigned by the organization's E-Business Point of Contact designated in the CCR.

"**Award**" means the written documentation executed by a DOE Contracting Officer, after an Applicant is selected, which contains the negotiated terms and conditions for providing Financial Assistance to the Applicant. A Financial Assistance Award may be either a Grant or a Cooperative Agreement.

"**Budget**" means the cost expenditure plan submitted in the Application, including both the DOE contribution and the Applicant Cost Share.

"**Consortium (plural consortia)**" means the group of organizations or individuals that have chosen to submit a single Application in response to a solicitation.

"**Contracting Officer**" means the DOE official authorized to execute Awards on behalf of DOE and who is responsible for the business management and non-program aspects of the Financial Assistance process.

"**Cooperative Agreement**" means a Financial Assistance instrument used by DOE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and Substantial Involvement (see definition below) is anticipated between DOE and the Applicant during the performance of the contemplated activity.

"**Cost Sharing**" means the respective share of Total Project Costs to be contributed by the Applicant and by DOE. The percentage of Applicant Cost Share is to be applied to the Total Project Cost (i.e., the sum of Applicant plus DOE Cost Shares) rather than to the DOE contribution alone.

"Central Contractor Registry (CCR)" is the primary database which collects, validates, stores and disseminates data in support of agency missions. Funding Opportunity Announcements which require application submission through Grants.gov require that the organization first be registered in the CCR at http://www.grants.gov/CCRRegister.

"Credential Provider" is an organization that validates the electronic identity of an individual through electronic credentials, PINS, and passwords for Grants.gov. Funding Opportunity Announcements which require application submission through Grants.gov require that the

individual applying on behalf of an organization first be registered with the Credential Provider at https://apply.grants.gov/OrcRegister.

"Data Universal Numbering System (DUNS) Number" is a unique nine-character identification number issued by Dun and Bradstreet (D&B). Organizations must have a DUNS number prior to registering in the CCR. Call 1-866-705-5711 to receive one free of charge. http://www.grants.gov/RequestaDUNS
"E-Business Point of Contact (POC)" is the individual who is designated as the Electronic Business Point of Contact in the CCR registration. This person is the sole authority of the organization with the capability of designating or revoking an individual's ability to submit grant applications on behalf of their organization through Grants.gov. http://www.grants.gov/assets/EBIZRegCheck.doc

"E-Find" is a Grants.gov webpage where you can search for Federal Funding Opportunities in FedGrants. http://www.grants.gov/search/searchHome.do

"**Financial Assistance**" means the transfer of money or property to an Applicant or Participant to accomplish a public purpose of support authorized by Federal statute through Grants or Cooperative Agreements and sub-awards. For DOE, it does not include direct loans, loan guarantees, price guarantees, purchase agreements, Cooperative Research and Development Agreements (CRADAs), or any other type of financial incentive instrument.

"Federally Funded Research and Development Center (FFRDC)" means a research laboratory as defined by Federal Acquisition Regulation 35.017.

"Funding Opportunity Announcement (FOA)" is a publicly available document by which a Federal agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. Funding opportunity announcements may be known as program announcements, notices of funding availability, solicitations, or other names depending on the agency and type of program.

"Grant" means a Financial Assistance instrument used by DOE to transfer money or property when the principal purpose of the transaction is to accomplish a public purpose of support or stimulation authorized by Federal statute, and no Substantial Involvement is anticipated between DOE and the Applicant during the performance of the contemplated activity.

"Grants.gov" is the "storefront" web portal which allows organizations to electronically find and apply for competitive grant opportunities from all Federal grant-making agencies. Grants.gov is THE single access point for over 900 grant programs offered by the 26 Federal grant-making agencies. http://www.grants.gov

"Industry Interactive Procurement System (IIPS)" is DOE's Internet-based procurement system which allows access to DOE's business opportunities database, allows user registration and submittal of Applications: http://e-center.doe.gov/.

"**Key Personnel**" means the individuals who will have significant roles in planning and implementing the proposed Project on the part of the Applicant and Participants, including FFRDCs.

"Marketing Partner Identification Number (MPIN)" is a very important password designated by your organization when registering in CCR. The E-Business Point of Contact will need the MPIN to login to Grants.gov to assign privileges to the individual(s) authorized to submit applications on behalf of your organization. The MPIN must have 9 digits containing at least

one alpha character (must be in capital letters) and one number (no spaces or special characters permitted).

"**Participant**" for purposes of this Solicitation only, means any entity, except the Applicant substantially involved in a Consortium, or other business arrangement (including all parties to the Application at any tier), responding to the Solicitation.

"**Project**" means the set of activities described in an Application, State plan, or other document that is approved by DOE for Financial Assistance (whether such Financial Assistance represents all or only a portion of the support necessary to carry out those activities).

"Proposal" is the term used in IIPS meaning the documentation submitted in response to a solicitation. Also see Application.

"Pure Edge Viewer" is a small, free program which allows you to access, complete and submit applications electronically and securely through Grants.gov. You will not be able to access, complete, or submit an application through Grants.gov, unless the Pure Edge Viewer is downloaded on your computer. http://www.grants.gov/DownloadViewer.

"Recipient" means the organization, individual, or other entity that receives a Financial Assistance Award from DOE, is financially accountable for the use of any DOE funds or property provided for the performance of the Project, and is legally responsible for carrying out the terms and condition of the award.

"**Selection**" means the determination by the DOE Selection Official that negotiations take place for certain Projects with the intent of awarding a Financial Assistance instrument.

"Selection Official" means the DOE official designated to select Applications for negotiation toward Award under a subject solicitation.

"**Substantial Involvement**" means involvement on the part of the Government. DOE's involvement may include shared responsibility for the performance of the Project; providing technical assistance or guidance which the Applicant is to follow; and the right to intervene in the conduct or performance of the Project. Such involvement will be negotiated with each Applicant prior to signing any agreement.

"**Total Project Cost**" means all the funds to complete the effort proposed by the Applicant, including DOE funds (including direct funding of any FFRDC) plus all other funds that will be committed by the Applicant as Cost Sharing.

Appendix B – Format and Instructions for the Project Narrative

The project narrative should provide the information listed in this Appendix. The project narrative will be evaluated relative to the criteria listed below. This will allow each application to be evaluated by a standardized and consistent set of information. Additional clarifying information is acceptable as long as the page limit is not exceeded. Unless noted, all items must be addressed in the page limit defined in Part IV.C.2. Please see the table at the end of this Appendix for unit measurements that must be employed.

This Appendix is a compilation of key items DOE considers important in assessing the ability of an applicant to design, construct, build and operate/validate an integrated biorefinery demonstration to lower the technical risks associated with financing a future commercial plant. It is intended to assist applicants in developing their project narrative. Depending on the project, it may be appropriate to add information not asked for in this Appendix or supplant certain areas with other information that better addresses the criteria. For example, the use of no-cost feedstocks is considered unrealistic. However, if an applicant can demonstrate that it can obtain a no-cost feedstock, with a long-term commitment by a supplier, and that it can replicate this operation in multiple places across the country, this economic factor may weigh positively into the quality of the application. Thus, the ability to employ use of no-cost feedstock as a means of operating profitably must be documented and sufficient information provided that can be validated rather than simply stated. The intent of asking applicants to follow this Appendix when crafting the narrative is to demonstrate that the proposed project will meet the FOA requirements in the best possible way. Anything less is inadequate.

Criterion 1. Commercialization Plan. The likelihood that the proposed technology will be successfully commercialized in the near- to-mid-term, assuming successful completion of this demonstration project (50%)

A. Feedstock and feed supply system: The extent to which the proposed feedstock(s) has the potential to contribute meaningfully, from a cost and volume perspective to reduction of oil imports and achieving the President's 2017 goal for renewable and alternative fuel production. **(12.5%)**

Instructions: In this section, an applicant should address:

1. Feedstock Requirements

a. Feedstock limitations - Demonstrate adherence to 932(a) (1-2) and Section 932(d) (1) (A) pertaining to the choice of a lignocellulosic feedstocks and adherence to the feedstock requirements in Part V. A. 1. Initial Review Criteria. Include estimates of available feedstock volumes and delivered cost to the plant gate that would support favorable economics (see Section A under "Economics" below) in producing a biofuel, bioproduct, or petroleum substitute. The resource assessment and cost estimate data must be fully documented. The sustainably available resource should represent an ultimate potential of no less than 100 million dry tones of biomass per year. If any one feedstock does

not satisfy this requirement, a combination of feedstocks that, in aggregate, represent 100 million dry tonnes per year may be proposed, provided that plans are included under Criterion 2 to demonstrate the viability of each feedstock. If more than one feedstock is proposed, a quantity-weighted average feedstock cost estimate must be used for the economic assessments requested herein (in addition to other sensitivity cases specified in this FOA). If available, include any demonstrations of commitment by feedstock suppliers.

b. Feedstock Interface with plant - Describe how the envisioned feedstock collection, storage, transport and pretreatment/preparation (if any) will be integrated into the operation and costs of the commercial-scale advanced biorefinery system being proposed.

c. Experience with biomass feedstocks - Provide the level of experience in handling large volumes of biomass feedstock (100 dry metric tonnes (110 dry tons) per day or more). Define how these large volumes of biomass feedstocks will be managed between the supplier and the user. Document pertinent supplier/applicant experience. In particular, provide detail on relevant experience in handling the specific, proposed biomass feedstock.

d. Feedstock source management - Describe in detail the level of experience in sustainably growing, harvesting, transporting, handling and storing large quantities of lignocellulosic feedstocks specifically destined for industrial processing. If a feedstock is proposed that requires novel equipment or changes to existing agricultural practices, plans to develop and deploy these systems must be presented. If the applicant or applicant's partner organization(s) does not currently have this experience, a plan should be presented for obtaining a partner with the required experience in this area.

Rating examples - A detailed feedstock availability and cost study will result in a higher score than assurances from a grower that the feedstock supply will be available. Experience with a process with a feedstock throughput of 200 tonnes per day producing the commensurate output of biofuels would rate somewhat higher in this category than a lower throughput process.

B. Economics, emissions and energy, competitive advantage, success factors: The extent to which the proposed process demonstrates compelling economics and competitive advantages that justify the demonstration of the proposed integrated system and the extent to which the project will demonstrate the critical factors to measure success. **(25%)**

Instructions: In this section, an applicant should address:

1. Process Economics:

a. Include an estimate of production costs of the product(s) and, if appropriate, compare such costs to that required to produce the same product(s) from petrochemical sources.

b. Provide an estimate of production cost for a first commercial plant ($/unit volume or $/unit mass). Discuss how cost and performance of the first commercial plant are expected to change between the first commercial and a mature, "Nth," plant. Provide the first commercial plant information in tabular form similar to that shown in the example in Appendix D.

   The application must include a table or graphic that shows the cost contributions by unit operation process, capital costs, and debt costs. An example of a cost-by-area graphic is provided for consideration in Appendix D. These will be used for comparison between applications and thus the units must be consistent. An applicant may choose to have a different format, but the same types of information must be included. Applications must employ a 2005 cost-year basis for all calculations.

   [*The example in Appendix D shows an ethanol from lignocellulosics production facility based on a base case analysis by the National Renewable Energy Laboratory for a biochemical based process (Aden, A. et.al, 2002, http://www.nrel.gov/docs/fy02osti/32438.pdf). This is simply a representative example. Do not simply replicate these tables or data].*

c. Discuss how cost and performance of the demonstration facility relate to the first commercial plant. Identify specific uncertainties or issues that will be resolved by operation of the demonstration facility and how they will contribute to design and operation of a commercially viable first plant if successfully resolved.

2. <u>Environment, energy and emissions</u>

a. Waste streams and emissions - Include an assessment of potential waste streams and emissions, and a means to manage or mitigate them, such as use of more efficient processing technologies. Use the estimators provided by the Industrial Technologies program to quantify reduction in waste emissions (http://www.energetics.com/ies_tool). The tool referenced here is offered as a means of helping an applicant to estimate such streams and emissions from energy use in an operating plant. It may not completely accommodate all configurations. DOE expects use of the tool where it makes logical sense with augmentation by engineering analyses to accommodate the balance of the operation in estimating waste streams and emissions. Show the emissions in kg/kg of product produced for this demonstration plant (current state of the art), the first commercial and "best commercial" (Nth) plant. The team should show here that the first and the Nth commercial plants will be viable and that compliance requirements will be met. The waste stream assessment must not only address steady state operations, but must also anticipate and address process upsets by showing an estimate of the range of wastes and emissions that will need to be managed.

b. Emissions and energy usage - Include an estimate of emissions and energy usage to produce the products. An energy and environmental life cycle analysis of the process from the delivery of the feedstock at the plant gate to final products or other approaches may be employed. Energy efficiency

savings through use of a lignocellulosic-based process is not being requested, rather how the applicant manages the waste streams and emissions from the energy sources employed.

c. Managing non-product streams - Provide strategies for managing non-product or byproduct streams, since it is assumed no process has 100 percent conversion efficiency 100 percent of the time. Express in kg/kg product produced or kg/1,000,000 Btu of product produced.

3. Competitive Advantage

a. Provide explanations of how the performance and/or economics of previous pilot-scale operations justifies proceeding with a more detailed and larger design at the scale proposed under this FOA.

b. What are the competing processes for producing the proposed end product(s) and what is the competitive advantage of the proposed process i.e. why is it better?

c. What is the competitive advantage to proceeding with this process compared to conventional routes (including petroleum/fossil derived) to the same or similar products? How does the proposed process advance technology or further national goals (e.g. energy security)

4. Critical Success Factors and Showstoppers

a. What have been the critical success factors that lead to considering scaling this process to the scale called for in this FOA? What showstoppers have been resolved or overcome during previous development efforts for this technology?

b. Have all the show stoppers in previous evaluations been addressed and overcome? If so, how?

c. What are the plans in this integrated demonstration to address the remaining potential technical showstoppers and are the business showstoppers addressed fully in the business plan description below?

d. What will be the critical success factors for this demonstration that will lead to consideration of proceeding to a full-scale commercial demonstration?

Rating Examples – An application professing to have competitive economics without explanation or detailed backup would be rated lower than an application that fully justifies its process economics. An application that cannot explain the advantages of its process over competing processes that produce like or similar products would be rated lower than one that can explain its position in the manufacturing arena. Applications that can define critical success factors with technical and economic metrics based on technical and process economic evaluations will rate higher than ones that simply provide success targets.

C. Business Plan: Provide information to assess the likelihood that the proposed business plan will lead to the successful near-to-mid-term commercialization and deployment of the integrated biorefinery. **(12.5%)**

Instructions: In this section, an applicant should address:

1. **Business and Market Plans -** This section should address the issues related to the value proposition of undertaking this effort to produce biobased fuels and the other products proposed in the application.

   a. Financial Assurances - Include information describing the types of financial assurances that are in place to ensure the project will be funded through completion of start-up and shakedown. Examples could include letters of intent, R&D investments to date by the team, ability to provide cost-share, evidence of track record for financing and implementing commercial scale projects, and cash-on-hand available to complete the project. The applicant should show that they have financial assurances to fund potential cost overruns.

   b. Continuity and continuous improvement - Assurance that continuity between pioneer and later plants is maintained. The applicant should also show that they invest in and effectively use R&D to further improve the technology with the goal of minimizing production costs. This should include a discussion of anticipated improvement from first commercial through Nth plants and the anticipated use, if any, of the facility proposed under this FOA in on-going process improvement.

   c. Pro-forma - Provide a pro-forma for the anticipated first, full-scale commercial operation that demonstrates projected commercial viability. The pro-forma should contain at least two sensitivity cases: 1) using an assumed ethanol selling price of $2.00/gallon (or an energy-equivalent cost for other, non-ethanol bio-fuels), a feedstock cost of $38/dry tonne, and a contingency of 30% for the capital construction phase of the project 2) using the applicant's best estimate of these parameters. Present the projected ROI for the commercial scale plant.

   d. Outputs and Business Strategies - Include an explanation of how the production of the outputs (fuels, products, etc) is consistent with the strategic business plans of the company or members of the applicant team.

   e. Customers – Identify customer(s) for the products being produced including any commitments to purchase products produced. If the customer is internal to the company, provide documentation of need by the internal customer.

   f. Business Risks – Identify business risks associated with producing the planned product(s) including an estimate of changing market dynamics

   g. Legal and Regulatory – Identify and discuss how legal and regulatory issues will be managed.

h. Liability insurance – Identify whether or not the team anticipates any issues in obtaining liability insurance for the plant or process. Provide evidence of ability to obtain liability insurance.

2. **Deployment Plan** - Include a deployment plan that provides explanations of the following:
   a. Future market prospects for similar plants based on successfully achieving the goals and objectives after operating the proposed system.

   b. Planned schedule for construction of the first full commercial scale operation

   c. Planned schedule for deployment and commercialization of additional operations based on successfully achieving the goals and objectives after operating the proposed demonstration validation

   d. Business, market and environmental risks for deploying additional operating facilities to other sites and the associated impact on the deployment schedule.

   e. Oil displacement - Include estimates of barrels of oil displaced via production of a biofuel, chemical or substitute for petroleum-based feedstocks or products. Estimates should be developed for this system if it were replicated at commercial-scale to its maximum potential, based on feedstock supplies.

   Provide the basis for feedstock supply estimates as well as the basis for estimates based on the Btu or Joule content of the output. Cite references on energy content of the fuel, chemical or substitute for petroleum-based feedstocks or products. Employ the following table to document oil displacement.

Calculating energy impacts in barrels of oil

Product: Fuel, chemical, or petrochemical substitute	Btu content per L or Kg (provide units) L in this case	Annual Volume planned for this demonstration plant in liters	Annual volume planned for the full scale plant in liters	Total btu per annum for the full-scale plant	Equivalent Barrels of Oil	Estimated Market Penetration (see note below)	Total barrels of oil displaced at full market penetration (replicated fully)
Ethanol	20,236	5,000,000	50,000,000	1.01E+12	174,448	5	872,241
				0	0		0
				0	0		0
				0	0		0
				0	0		0
				0	0		0

Notes for Table: Ethanol is given as an example. Assume a higher heating value (HHV) of 5.8×10^6 btu or 6.1×10^9 joules in a barrel of oil. In general, employ the lower heating value (LHV) of any biofuel or product produced (ethanol is 20,236 btu/L or 76,594 btu/gal per the API Technical Data Book). It is recognized that the numbers for a barrel of oil cited here are the HHV. If you can correct to the HHV for the biofuel please do so. Include the basis and assumptions used for the correction to

the HHV for the biofuel. If not, indicate so in your estimates. (Since the Energy Information Agency does not provide the hydrogen content of gasoline or crude oil, it is hard to estimate a LHV for comparison and best estimates are requested). In this table, show barrels of oil displaced for this plant and the total barrels of oil displaced based on a realistic market penetration estimate if the operation is producing products successfully. Represent % market penetration by the number of plants with specific output capacity anticipated being built that would meet the output needs for projected markets in 2015. Use EIA market projections, Chemical Economics Handbook values or other citable source for 2015 numbers

Rating examples – An application containing undocumented promises of resources would be considered to have poorly met these instructions. An application that simply states that another plant could be deployed if their demonstration is successful would rate lower than an application that outlines the issues and risks in building another facility within their own site or other locations. Biorefinery systems that can be employed across multiple regions of the United States and with a wide range of feedstocks are desirable but not required. An application that does not consider the changing market dynamics for the products being produced would be rated lower than one that at least contains a discussion of market realities, now and in the future. A technology that has the potential to displace significant amounts of oil imports (and supports this estimate with credible sources) would score higher than one with lower displacement potential or with poor or no supporting documentation.

Criterion 2. Demonstration Plan. The likelihood that the proposed project is able to demonstrate the integration of multiple unit operations in producing at least one fungible biofuel or multiple products (including a fungible biofuel as the primary product), and the extent to which the proposed project supports the Commercialization Plan presented in Criterion 1 (50%)

A. Approach: The extent to which the proposed feedstock, process engineering evaluations of the proposed technology or system, biorefinery siting, energy, emissions, and economic analyses are properly developed, and the extent to which the project demonstrates that the proposed biorefinery technology can potentially operate as an integrated system to economically produce any one or more of the products listed in Section 932(d)(1)(B)(i-iii). **(25%)**

Instructions: In this section, an applicant should address:

Proposed Process With Economic And Engineering Justifications For Conducting A Demonstration At Up To 10% Scale At The Proposed Site(s)

Provide evidence of the proposed process' maturity that justifies proceeding to the prototype demonstration project contained in this application. This FOA focuses on systems meeting the guidance in Section 932(c) (1,2 and 4). Preference will be given to projects that demonstrate novel or breakthrough technologies, that include appropriate collaboration between and among industrial, academic and national laboratory interests, and that produce, as the primary product, bio-based fuels that are fungible replacements for liquid transportation fuels currently used in the existing infrastructure. Biorefinery technologies and systems are sought that can proceed rapidly to commercial demonstration following successful completion of the proposed project.

1. **Process engineering evaluations** - Include process engineering evaluations that justify the readiness of the process for piloting at up to 10 percent scale. This includes thorough evaluations of process chemistry, closed mass and energy balances, solids handling issues, materials of construction, corrosion issues, waste management issues, control and instrumentation issues and the engineering involved in product isolation, characterization, and purification. These evaluations must be based on, and described with references to, findings from prior small-scale pilot plants or process development units. The application must include process flow diagrams with stream details. The information and evaluation provided needs to show that the scale chosen is about 10 percent of what the applicant would anticipate as a full scale commercial operation. The decision in scale should be justified based on scalability of individual processes or process steps. The applicant should identify those areas that would face the largest uncertainties of scaling from the demonstration phase to full scale commercial operation and what actions will be taken to mitigate these risks.

   Applicants with a significant and successful history of commercial scale-up (including financing) of similar processes (e.g., similar amount of new technology,

solids processing units and other difficult to scale-up unit operations) based on integrated demonstrations smaller than 10 percent may propose a smaller demonstration facility along with clear and convincing evidence of their past scale-up success. In any case, the proposed integrated demonstration facility must produce a minimum of 1.5 million gallons of bio-based fuel per year and process a minimum of 70 tons per day of feedstock.

Describe in detail the data and information (including lengths of runs, duplication of data, validation of data, etc.) to be obtained from the 10 percent scale demonstration plant and how it will be used to complete process engineering for the commercial scale plant. This section should include:

a. Validated pilot plant data that forms the basis for the design of this demonstration facility, or a plan to complete needed pilot plant testing or additional R&D prior to start of this demonstration facility. This must include completion of Table 1 for each process step or unit operation.

b. Descriptions of any unit operation that are part of the full scale facility that are not included in this proposed demonstration facility and why they do not need to be operated as part of this facility to develop the necessary design data for scale-up to production. Typically these units are outside any major recycle and are performing a common process. A plan must be included on how the scale-up data for these unit operations will be developed. Examples might include; ethanol rectification and dehydration – beer column overheads will be sampled and distillation simulation will be used to design these unit operations because they are standard practice, lignin combustion – significant quantities of lignin generated in this process will be sent off site to be tested for combustion properties by the combustor manufacturer who will also guarantee the unit, solids drying – samples will be sent to the vendor for testing and unit operation design and guarantee.

c. Written description of each step of the proposed process.

d. Full material and energy balances.

e. Comprehensive process flow diagrams (PFDs) for the commercial scale plant. This should be developed using information from prior piloting or process development activities.

f. Fully developed PFDs for the 10 percent demonstration plant with justification for any modifications from the PFDs for the commercial scale plant. Clear explanation of scaling issues of each process step, both scaling down to the 10 percent scale and then scaling back up to the commercial plant scale.

g. Technology risk assessment and management plan.

h. Provide a list of equipment to be installed by the project. Show availability of the equipment for both scales: the 10 percent demonstration plant and the commercial plant.

i. Justification of the choice of materials used for the equipment and bulk materials employed in the 10 percent demonstration plant. Describe availability, feasibility and economic viability of these materials in a

commercial scale plant. Discuss any plans for materials testing during the project (e.g. coupon testing).

j. A description of instrumentation and control system to be installed for the 10 percent demonstration plant. The control system must mimic that of the commercial plant; however, in addition, instrumentation should be adequate to allow for the collection of data to address process, temperature, corrosion, impurity, and control/instrumentation issues.

k. Description of the data and information to be obtained from the 10 percent scale demonstration plant to complete process engineering for the commercial scale plant.

l. Description of demonstration plant features that allow for a comprehensive study of the process at a 10 percent scale. Features such as ease of modification, exchange or addition of equipment and access to monitor and maintain the facility components.

Table 1. Process Development and Piloting Information

Include all information for the sources of the most definitive process development data

	Type of Facility [a]	Process Units Involved	Scaleup[b]	Capacity (units)	Start Date of Operation	End Date of Operation	Longest Continuous Run
a.							
b.							
c.							
d.							
e.							
f.							
h.							
i.							

[a] For example, bench scale unit, process development unit, small pilot, partially integrated pilot, integrated pilot, components testing facility, semiworks, or demonstration facility.

[b] Scaleup = Commercial unit capacity divided by test unit capacity.

1. Describe how data collected from each of these facilities were used to calculate basic design data, including heat and materials balances, and to better understand the process.

2. Did any of these facilities pilot recycle streams? Describe (e.g. how long was the recycle run and was steady state achieved).

3. Are there any differences in the process as piloted and the process as it will be run in a commercial plant in any of the following areas (if so, please explain):

Feedstock:

Mode of operation (for example: batch vs. continuous):

Materials of construction:

2. **Integrated biorefinery demonstration plant siting issues**– ***Technical, legal and economic***. Siting considerations must include explanations related to feedstock sources and availability. If the proposed system will be integrated into an existing facility, provide an explanation of the benefits and justification for siting along side or as part of such an existing facility. Provide information on who holds title to the land or existing facilities. Proof of rights to use the land or the existing facility for a biorefinery should be provided for the scheduled period of performance. For a new site, provide justification and benefits for developing a new site. Information should include discussions of cost management, sharing of resources or utilities, transportation infrastructure, and other relevant information.

   Please provide any impacts on production costs, if any.

3. **Integrated biorefinery demonstration plant siting issues**— ***Environmental.*** Explain environmental issues, such as environmental impact assessments that may be required; considerations including use of genetically modified organisms (if employed) or Toxic Substances Control Act (TSCA) requirements that may be imposed due to manufacture of new compounds; and any other permitting issues that are anticipated. Provide a plan for dealing with these environmental issues, or if permits already exist, explain how these existing permits will accommodate the environmental issues in demonstrating this process. List and describe the environmental, pollution control, land use, zoning, licenses and agreements that will be required for the life of the project. Include estimated costs for obtaining and maintaining compliance. Include plans and costs for complying with the National Environmental Policy Act (NEPA, ref. http://www.eh.doe.gov/nepa/) as this will expedite negotiations if an application is selected for award.

   Please provide any impacts on production costs, if any.

Rating examples – A proposed integrated biorefinery operation based on a previous pilot-plant or semi-works operation would receive better scores than one with a lesser level of experience. Scores will be commensurate with the progress made to date and the level of completeness of environmental permitting, environmental impact assessments, as well as other federal, regional and local permits and regulations supporting the plant's operation. At a minimum, all permitting processes and regulation requirements must be identified with anticipated timelines. Failure to address the permitting and regulatory process will be considered non-responsive. A timeline justified by experience would rate higher consideration than a timeline based simply on estimates.

B. **<u>Feasibility</u>**: The likelihood that the proposed demonstration will collect sufficient quality data for final design of a full-scale commercial facility within the proposed budget and the schedule by the team given their experience, past performance, past progress on the proposed technology, available financial and material resources, project plan, proposed budget and operational management. **(25%)**

<u>Instructions</u>: In this section, an applicant should address:

1. **Project Plan -** Include a comprehensive Project Execution Plan that will guide the design, engineering, construction, startup, operation and data analysis and interpretation for design of the integrated biorefinery demonstration. As a minimum, the Project Plan must include:

    a. Description of prior successful technical projects of this scale by the applicant and associated team members including an identification of vendors and partners involved.

    b. Description of the selection process for an engineering, procurement, and construction (EPC) firm, if used for the project.

    c. Description of the capabilities of internal resources, if used for the project.

    d. A schedule or Project Work Plan. The schedule should include time periods for design, procurement, construction, and start-up and shake-down, as well as development of environmental and land-use agreements, obtaining permits and licenses, and obtaining financing. Budgets should be provided as requested in Part IV.C.

    e. Minimum design specifications in which process flow diagrams are coupled to preliminary cost estimates (internally or from an EPC contractor).

    f. Planned project management tools, including Gantt charts, resource based scheduling, or other methods to assess progress and track progress. These would include methods to assess actual cost and schedule versus planned cost and schedule, etc.

    g. Plans for staffing, including identification of costs and resources required to design, engineer and construct the proposed facility. This could involve proposals from third party operators.

    h. Justification for the schedule for completing the proposed integrated biorefinery based on the applicant's professional evaluation or that of their EPC firms, if such are employed.

    i. Contingency planning to address cost overruns and schedule slippage.

    j. A comprehensive plan that addresses how the team will handle design changes during construction, startup issues and potentially walk-away criteria.

    k. Planned period of operation of the demonstration biorefinery to successfully demonstrate the feasibility of the technology and the justification for the selected duration of the test. The operation should include sufficient time to demonstrate the reliability and maintenance issues of the biorefinery to the satisfaction of prospective equity or debt partners. A data collection, analysis and reconciliation plan should be included. In addition, discuss how the team will respond to unexpected data or problems that might need reconfiguration or modifications of the operating facility.

    l. Description of a safety plan during execution of the project and during operation.

    m. Description of a gated company work process to execute project (if there is one established).

    Note: Federal matching funds will be allocated for up to 10 percent of the total cost for preliminary engineering and permitting. Federal funds for detailed engineering, procurement and construction will only be committed after the completion and issuance of the appropriate permits. This evaluation will be conducted by DOE project

management personnel as part of DOE's substantial involvement in the project. (See Part VI.B)

2. **Team qualifications** - Address the qualifications of the team undertaking the work, including an explanation of the:
   a. Availability of the personnel for a fully represented project team. The key functions on the project team are engineering, R&D, maintenance, operations and business.
   b. Experience in designing, engineering and constructing similar sized operations.
   c. Experience in operating biofuels or chemical processing facilities such that compliance with related environmental standards and regulations is maintained
   d. Experience in operating biofuels or chemical processing facilities such that compliance with related health and safety standards and regulations is maintained
   e. Experience in operating similarly sized operations including the ability to analyze data, to manage excursions from normal operations, and to troubleshoot problems. Expertise in design & build, scale-up/pilot testing, plant ownership and operation, permitting, feedstock acquisition, and raw material management. If biological processing is involved, experience of team members in fermentation processing and bioengineering. Evidence of commercial scale experience in all proposed key technology areas, including solids handling, solids separation, fermentation, chemical catalysis, purification of products, etc.
   f. Methods to be used to ensure good team alignment, good communication, conscious awareness of the importance of building good teams and senior management buy-in to whatever risks are being taken.
   g. Communications pathways within the team and between the team and outside entities, such as utilities, suppliers, fabricators, end-users, customers, DOE, etc.

3. **Estimating methods** - Explain the methods employed to estimate capital construction costs and future operating costs, such as the:
   a. Bases and assumptions for all estimates, whether generated internally or by a third party
   b. Linkages between resources and work schedule
   c. Start-up, commissioning and operational plans that identify the data needed, staffing needs, reporting requirements and steps needed to optimize the design, engineer and construct of the facility.

4. **Operational management plan** - Provide an explanation of the operational management plan including
   a. Plans for staffing, with an identification of costs and resources required to operate the proposed facility. This could involve proposals from third party operators
   b. Planned project management tools including Gantt charts, resource based scheduling, analytical tools or other methods to assess operation and measure production of outputs.
   c. Use of cost management tools

Rating Examples – Experience at scales commensurate with those in the application will be rated more favorably than experience only at smaller scales. Teams that possess collectively the skills needed comprise a satisfactory team of applicants. A team that demonstrates proficiency in the areas of technology, running projects and commercialization will score higher than one with proficiency in only one or two of these areas. A comprehensive list of all major pieces of equipment with the sizes and materials of construction specified would rate higher than a simple list of equipment needs. Engineering simulations or plans that identify recycle loops but do not show how to close or converge such loops would be rated lower. Documentation on how an engineer, procure and construct (EPC) firm is selected and plans for using the EPC firm would rate higher than simply stating that an EPC firm as a subcontractor or partner will help in the execution of the project.

Units to be employed throughout the application:

Value or Measure	**Metric Units**	**English Units**
Yields	kg or L/tonne feedstock supplied	lb or gal/ton feedstock supplied
Process Conversion Yields	Percent of theoretical yield	
Throughput volumes	L or kg/hr	Gallons or lbs/hr
Product concentrations	kg or g/L	lb or lb/gal
Weight percentages	wt/wt	
Electricity	kW	
Energy use	kW/dry tonne product or kW/L product (at specific concentration, if applicable)	kW/dry ton product or kW/gal product (at a specific concentration, if applicable)
Overall plant biofuel capacity	L per annum	Gallons per annum
Overall plant product capacity (other than fuel)	L or kg/dry ton feedstock/annum	Gallons or lb/dry ton feedstock/annum
Overall plant capacity or use for heat or power	Million Btu/dry tonne of feedstock or kWh/dry tonne feedstock per annum	Million Btu/dry ton of feedstock or kWh/dry ton feedstock per annum
Emissions outputs	kg/kg product produced	lb/lb product produced
Capital and equipment costs	Designate as purchased, installed or total investment (with indirect costs included). Employ a 2005 year cost basis	
Life cycle assessment or analysis information	Reduction in fossil energy usage (see units above) or reduction in emissions from use of biomass (see units above)	

Appendix C - EPAct 2005 Sec. 932. BIOENERGY PROGRAM.

(a) DEFINITIONS:.—In this section:

(1) BIOMASS.—The term “biomass” means—

(A) any organic material grown for the purpose of being converted to energy;

(B) any organic byproduct of agriculture (including wastes from food production and processing) that can be converted into energy; or

(C) any waste material that can be converted to energy, is segregated from other waste materials, and is derived from—

(i) any of the following forest-related resources: mill residues, precommercial thinnings, slash, brush, or otherwise non-merchantable material; or

(ii) wood waste materials, including waste pallets, crates, dunnage, manufacturing and construction wood wastes (other than pressure-treated, chemically-treated, or painted wood wastes), and landscape or right-of-way tree trimmings, but not including municipal solid waste, gas derived from the biodegradation of municipal solid waste or paper that is commonly recycled.

(2) LIGNOCELLULOSIC FEEDSTOCK.—The term “lignocellulosic feedstock” means any portion of a plant or coproduct from conversion, including crops, trees, forest residues, and agricultural residues *not specifically grown for food*, [emphasis added] including from barley grain, grapeseed, rice bran, rice hulls, rice straw, soybean matter, and sugarcane bagasse.

(b) PROGRAM.—The Secretary shall conduct a program of research, development, demonstration, and commercial application for bioenergy, including—

(1) biopower energy systems;

(2) biofuels;

(3) bioproducts;

(4) integrated biorefineries that may produce biopower, biofuels, and bioproducts;

(5) cross-cutting research and development in feedstocks; and

(6) economic analysis

(c) BIOFUELS AND BIOPRODUCTS.—The goals of the biofuels and bioproducts programs shall be to develop, in partnership with industry and institutions of higher education—

(1) advanced biochemical and thermochemical conversion technologies capable of making fuels from lignocellulosic feedstocks that are price-competitive with gasoline or diesel in either internal combustion engines or fuel cell-powered vehicles;

(2) advanced biotechnology processes capable of making biofuels and bioproducts with

emphasis on development of biorefinery technologies using enzyme-based processing systems;

(3) advanced biotechnology processes capable of increasing energy production from lignocellulosic feedstocks, with emphasis on reducing the dependence of industry on fossil fuels in manufacturing facilities; and

(4) other advanced processes that will enable the development of cost-effective bioproducts, including biofuels.

(d) INTEGRATED BIOREFINERY DEMONSTRATION PROJECTS—

(1) IN GENERAL.—The Secretary shall carry out a program to demonstrate the commercial application of integrated biorefineries. The Secretary shall ensure geographical distribution of biorefinery demonstrations under this subsection. The Secretary shall not provide more than $100,000,000 under this subsection for any single biorefinery demonstration. In making awards under this subsection, the Secretary shall encourage—

(A) the demonstration of a wide variety of lignocellulosic feedstocks;

(B) the commercial application of biomass technologies for a variety of uses, including –

(i) Liquid transportation fuels;

(ii) High-value biobased chemicals

(iii) Substitutes for petroleum-based feedstocks and products; and

(iv) Energy in the form of electricity or useful heat; and

(C) the demonstration of the collection and treatment of a variety of biomass feedstocks.

(2) PROPOSALS.—Not later than 6 months after the date of enactment of this Act, the Secretary shall solicit proposals for demonstration of advanced biorefineries. The Secretary shall select only proposals that—

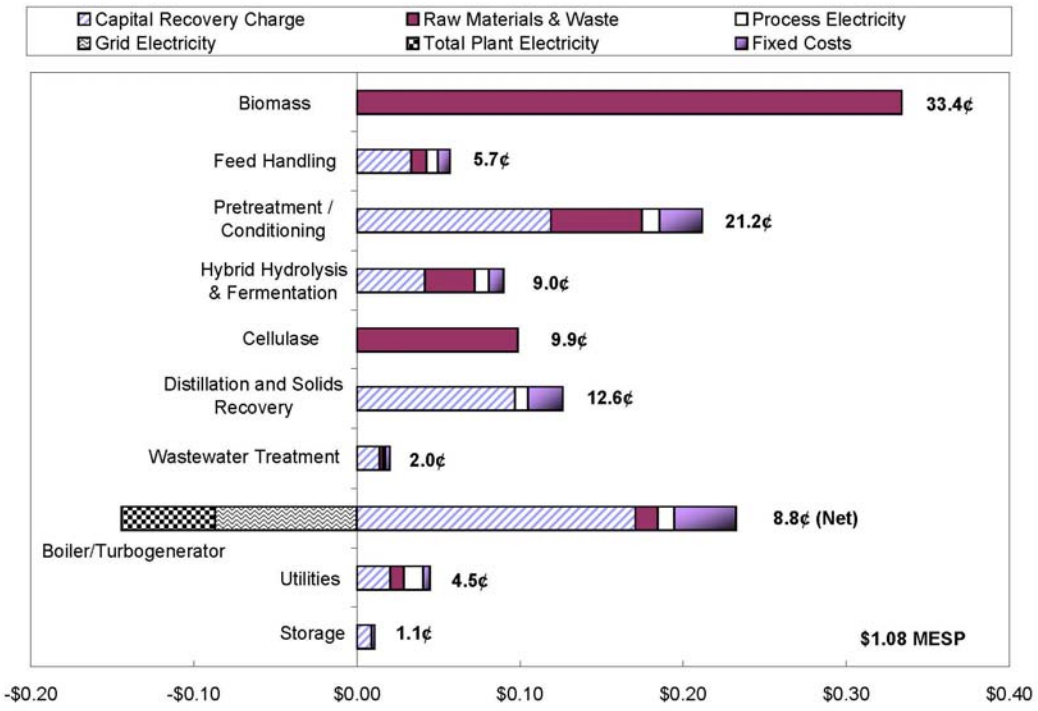
(A) demonstrate that the project will be able to operate profitably without direct Federal subsidy after initial construction costs are paid; and

(B) enable the biorefinery to be easily replicated.

Appendix D– Example of an Ethanol Production Process from Lignocellulosics

(Based on the NREL base case model, Aden, A, et. al, 2002 - http://www.nrel.gov/docs/fy02osti/32438.pdf with some artificial inputs for demonstration purposes only)

Cost by Area Figure - Example



SUMMARY

ETHANOL COST OF PRODUCTION - Variable costs only	**$37,973,385/year**	**$0.55 /gal**
FIXED COST CONTRIBUTION	**$7,744,000/year**	**$0.11 /gal**
DEBT SERVICE (not a real value, an estimate)	**$4,675,004/year**	**$0.07 /gal**
MINIMUM ETHANOL SALES PRICE		**$0.73 /gal**

Cost Summary	COST PER UNIT	UNIT	ANNUAL PRODUCTION /CONSUMPTION	ANNUAL COST/REVENUE	COST PER GALLON
ANNUAL ETHANOL PRODUCTION		gallons	69,351,000.0		
Gallons per unit feedstock	$89.81	**Formatting of this cell.**			
		VARIABLE COSTS			
Raw Materials:					
Feedstock	$30.00	ton	772,162.5	$23,164,874/year	$0.33 /gal
Boiler Fuel -- Coal				$0/year	$0.00 /gal
Boiler Fuel -- Natural Gas				$0/year	$0.00 /gal
Boiler Fuel -- Biomass				$0/year	$0.00 /gal
Clarifier Polymer	$1.26	lb	526,215.6	$661,716/year	$0.01 /gal
Caustic				$0/year	$0.00 /gal
Sulfuric Acid	$0.01	lb	61,969,032.0	$774,613/year	$0.01 /gal
Hydrated Lime	$0.04	lb	45,173,844.0	$1,581,085/year	$0.02 /gal
Anhydrous Ammonia				$0/year	$0.00 /gal
Corn Steep Liquor	$0.08	lb	24,167,250.0	$1,909,213/year	$0.03 /gal
Purchased Enzymes	$0.06	lb	126,476,676.0	$7,209,171/year	$0.10 /gal
Purchased Fermenting Organism				$0/year	$0.00 /gal
Urea				$0/year	$0.00 /gal
Diammonium Phosphate	$0.07	lb	3,017,754.0	$214,261/year	$0.00 /gal
Propane	$0.00	lb	378,270.0	$870/year	$0.00 /gal
Makeup Water	$0.20	ton	1,797,013.7	$359,403/year	$0.01 /gal
Boiler Chemicals	$1.69	lb	16,812.0	$28,466/year	$0.00 /gal
Cooling Tower Chemicals	$1.05	lb	33,624.0	$35,420/year	$0.00 /gal
Wastewater Chemicals	$0.16	lb	924,660.0	$150,720/year	$0.00 /gal
Wastewater Polymer	$2.63	lb	3,110.2	$8,191/year	$0.00 /gal
Denaturant	$0.10	lb	18,905,094.0	$1,875,385/year	$0.03 /gal
Royalties IP Fees				$0/year	$0.00 /gal
additional materials (list below)					
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
Waste Stream Disposal costs:					
Ash from boiler	$21.60	ton	40,374.0	$872,079/year	$0.01 /gal
Gypsum	$21.60	ton	68,092.8	$1,470,805/year	$0.02 /gal
Waste water disposal				$0/year	$0.00 /gal
Additional Disposal costs (List)					
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
TOTAL WASTE DISPOSAL COSTS				**$2,342,883/year**	**$0.03 /gal**

Purchased Utilities (Credits as negative values)					
Electricity	$0.04	kWh	-144,120,870.0	-$6,038,664/year	($0.09)
Cooling Water				$0/year	$0.00 /gal
Steam -- High Pressure				$0/year	$0.00 /gal
Steam -- Low Pressure				$0/year	$0.00 /gal
Periodic Major Replacements					
Baghouse bags	$351,000.00		0.2	$70,200/year	$0.00 /gal
Ion exchange resin				$0/year	$0.00 /gal
Additional replacement costs (List)					
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
COST OF PRODUCTION				**########**	**$0.55 /gal**
			FIXED COSTS		
General & Administrative Fixed Costs					
Salaries with fringe	$2,274,000.00		1.0	$2,274,000/year	$0.03 /gal
Overhead	$1,364,000.00		1.0	$1,364,000/year	$0.02 /gal
Maintenance	$2,281,000.00		1.0	$2,281,000/year	$0.03 /gal
Insurance	$1,825,000.00		1.0	$1,825,000/year	$0.03 /gal
Property Taxes				$0/year	$0.00 /gal
Warehouse fees				$0/year	$0.00 /gal
Additional fixed costs costs (List)					
				$0/year	$0.00 /gal
Yellow formatting here?				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
				$0/year	$0.00 /gal
TOTAL FIXED COSTS				**$7,744,000/year**	**$0.11 /gal**
CAPEX					
Total Plant Hard Cost				$114,049,000	1.644518464
Other Costs unless included above					
Site Development				$5,915,000	0.085290767
Field Expenses				$24,335,000	0.350896166
Home Office & Construction Fee				$30,419,000	0.438623812
Project Contingency				$3,650,000	0.05263082
Permits				$18,008,000	0.259664605
Start Up Costs				$0	0
Other (list below)				$0	0
Warehouse				$1,711,000	0.024671598
Allow for other costs?				$0	0
TOTAL PLANT				**$198,087,000**	**$2.86 /gallon**
Financing					
% Equity	100.000%		EQUITY	$198,087,000	
Loan rate	4.900%				
Loan term (YEARS)	5		DEBT	$7,500,000	

Description	2002 Design Report Target Case
Feedstock Solids Analysis:	
Feedstock	Corn Stover
Feedstock Flow (dry tonne/day)	2000
Solids Analysis:	
Cellulose	37.4%
Xylan	21.1%
Arabinan	2.9%
Mannan	1.6%
Galactan	1.9%
Lignin	18.0%
Extractives	4.7%
Ash	5.2%
Acetate	2.9%
Protein	3.1%
Unknown Soluble Solids	1.1%
Total Solids	85.0%
Pretreatment:	
Type	Continuous Dilute Sulfuric Acid
Acid Loading (kg acid/kg dry biomass)	0.025
Total Solids Concentration (g/g)	30%
Temperature (°C)	190
Pressure (atm)	12
Residence Time (min.)	2
Yields:	
Cellulose to Glucolig	0.7%
Cellulose to Cellobiose	0.7%
Cellulose to Glucose	7.0%
Cellulose to HMF	0.0%
Xylan to Oligomer	2.5%
Xylan to Xylose	90.0%
Xylan to Furfural	5.0%
Xylan to Tar	0.0%
Mannan to Oligomer	2.5%
Mannan to Mannose	90.0%
Mannan to HMF	5.0%
Galactan to Oligomer	2.5%
Galactan to Galactose	90.0%
Galactan to HMF	5.0%
Arabinan to Oligomer	2.5%
Arabinan to Arabinose	90.0%
Arabinan to Furfural	5.0%
Arabinan to Tar	0.0%
Acetate to Oligomer	0.0%
Acetate to Acetic Acid	100.0%
Furfural to Tar	100.0%
HMF to Tar	100.0%
Lignin to Soluble Lignin	5.0%
Injection Steam #1 (kg/hr)	10,730
Injection Steam #2 (kg/hr)	37,154
Recycle Water to PT Reactor (kg/hr)	100,141
Reactor material of construction	316 SS
Conditioning	
Type of Conditioning	Overliming
Lime Addition (g/g hydrolysate)	0.33%
Conversion of Ca(OH)2 to Gypsum	1
Sugar Losses	0.00%

Solid/Liquid Separation

Solids Washing	
Wash Water Temperature (°C)	57
S/L Separation Temperature (°C)	68
S/L Separation Pressure (atm)	1
Water/Hydrolyzate Ratio (kg/kg)	0.58
Water to S/L Separator (kg/hr)	135,591
Dilution Water (kg/hr)	63,113
Gypsum removed	5,635
Gypsum to process (kg/hr)	28

Acetic Acid Removal None

Enzyme Production

Produced In-house or Purchased	Purchased
Purchase Price ($/gal ethanol)	$0.104
Purchase Price ($/ton)	$108.23
Price from metric ($/gal ethanol)	$0.137
Enzyme loading (FPU/g Cellulose)	12
Enzyme Concentration (FPU/mL)	50

Saccharification & Fermentation	
Hydrolysis Residence Time (days)	1.5
Hydrolysis Temperature (°C)	65
Fermentation Residence Time (days)	1.5
Fermentation Temperature (°C)	41
Time percentage that chilled H2O is necessary	0.0%
Total Solids to Saccharification (wt%)	20.0%
CSL Loading	0.0025
DAP Loading (g/L)	0.33
Saccharification Yields	
Cellulose to Glucolig	4.0%
Cellulose to Cellobiose	1.2%
Cellulose to Glucose	90.0%
Glucolig to Cellobiose	0.0%
Glucolig to Glucose	0.0%
Cellobiose to Glucose	100.0%
Fermentation Yields	
Glucose to Ethanol	95.0%
Glucose to Zymo	2.0%
Glucose to Glycerol	0.4%
Glucose to Succinic Acid	0.6%
Glucose to Acetic Acid	1.5%
Glucose to Lactic Acid	0.2%
Xylose to Ethanol	85.0%
Xylose to Zymo	1.9%
Xylose to Glycerol	0.3%
Xylose to Xylitol	4.6%
Xylose to Succinic Acid	0.9%
Xylose to Acetic Acid	1.4%
Xylose to Lactic Acid	0.2%
Arabinose to Ethanol	85.0%
Arabinose to Zymo	1.9%
Arabinose to Glycerol	0.3%
Arabinose to Succinic Acid	1.5%
Arabinose to Acetic Acid	1.4%
Arabinose to Lactic Acid	0.2%
Galactose to Ethanol	85.0%
Galactose to Zymo	1.9%
Galactose to Glycerol	0.3%
Galactose to Succinic Acid	1.5%
Galactose to Acetic Acid	1.4%
Galactose to Lactic Acid	0.2%
Mannose to Ethanol	85.0%
Mannose to Zymo	1.9%
Mannose to Glycerol	0.3%
Mannose to Succinic Acid	1.5%
Mannose to Acetic Acid	1.4%
Mannose to Lactic Acid	0.2%
Contamination Loss	3.0%
% of Theoretical Ethanol Yield	79.7%
Soluble Sugars From Pretreatment (kg/hr)	27,686
Other Soluble Solids From Pretreatment (kg/hr)	10,551
Soluble Sugars in Purchased Cellulase (kg/hr)	0
Other Soluble Solids in Purchased Cellulase (kg/hr)	0
Soluble Sugars in Produced Cellulase (kg/hr)	0
Other Soluble Solids in Produced Cellulase (kg/hr)	0
Soluble Sugars From Saccharification (kg/hr)	51,869
Other Soluble Solids From Saccharification (kg/hr)	9,496
Soluble Sugars From Seed Train (kg/hr)	614
Other Soluble Solids From Seed Train (kg/hr)	1,159
Soluble Sugars From DAP (kg/hr)	0
Other Soluble Solids From DAP (kg/hr)	0
Soluble Sugars From CSL (kg/hr)	0
Other Soluble Solids From CSL (kg/hr)	542
Total Solids to Fermentation (wt%)	19.7%
Fermenter Agitator Power (HP per 1000 gal)	0.15
Ethanol Concentration Out of Fermenters (wt%)	6.2%

Calculation of Monthly Debt Service Payment

Loan Term Years	Interest Rate Monthly Int Rate (rate)	Monthly Payments (nper)	Loan Amount (pv)	Monthly Debt Service Payment	Loan Commitment Fee
	4.900%				**0.000%**
5	4.90%	60	**$7,500,000**	**$389,584**	**$0**

ANNUAL DEBT SERVICE OUTLAY $4,675,004.17